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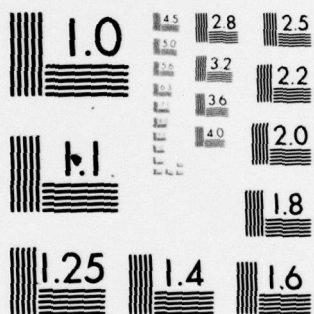
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DEVELOPMENT OF A NEW METHOD OF PRESURGICAL SCRUB

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Perhaps no procedure in medicine has remained as unchanged as the way in which the hands are cleansed prior to surgery. In the past, different drugs have been used, but the cumbersome and time consuming use of a brush or sponge to mechanically remove bacteria from the hands remains the same. The Department of OB-GYN at Walter Reed Army Medical Center expressed initial skepticism when approached by a group of researchers at the U. S. Army Institute of Dental Researchers to clinically evaluate a new method of hand washing. However, after reviewing the work they had already accomplished in developing a related instrument for wound debridement and decontamination (The Army Medical Irrigator) and the promising results from nonclinical studies using this method for hand cleansing, a trial in the hospital environment by our department seemed warranted.

The method to be studied had its beginnings in the same principle used in the "Water Pik" (Teledyne Aqua Tec Co., Fort Collins, Colorado). Pulsating jets of water at pressures ranging up to 70 psi had been found to be an atraumatic means of removing particulate matter and bacteria from teeth and gums while reducing inflammation and plaque formation.¹ The pulsed delivery of water was found to be more effective than a constant stream of water in removing small particles, and caused less tissue irritation.

In 1966 USAIDR began expanding this principle to the cleansing and debridement of experimental^{2,3} and combat wounds suffered in Vietnam (The Army Medical Irrigator⁴).

The original instrument delivered a continuous jet of water at pressures up to 200 psi (Fig. 1). Several modifications made the device more effective. The water was delivered in a pulsed manner (800-2100 pulses per second). Antiseptic agents and antibiotics were added to the irrigating solution,⁵⁻⁷ and multiple jets were added to increase the area which could be cleansed. A contract was awarded to a commercial firm to manufacture multiple units for use in Vietnam, using Army specifications (Fig. 2). This same type of unit is now being used in many civilian hospitals for the treatment of gunshot and other contaminated wounds.

Due to the proven efficacy of the pulsed water principle, it was decided to test this approach to the presurgical cleansing of hands. Several problems inherent in the routine method of scrub in use today have been discussed:⁸ (1) It is time consuming. (2) Resident bacteria may not be removed. (3) Bacteria may not be removed from areas beneath or around fingernails. (4) Some individuals are sensitive to antiseptics and detergents.

The initial study⁸ was conducted using a short cylindrical device called a hydroscrub, into which one could insert a hand to just above the wrist (Figs. 3 & 4). The wall of the cylinder contained multiple jets through which various types of antiseptic solutions could be delivered. This first study showed a 90 second hydroscrub to be far superior to a standard 10 minute scrub. Comparison of the two methods was based on the number of bacteria grown on fingertip cultures and on the microbial counts of a saline solution used to irrigate the inside

of a sterile glove worn for one hour after the initial scrub. In this study no attempt was made to compare the effectiveness of both methods in eliminating the microorganisms from the subungual areas or to evaluate the individual sensitivity to antiseptic preparations. It was shown, however, that the 90 second hydroscrub saved time, caused less skin irritation, and was superior to the 10 minute conventional scrub in eliminating microorganisms from hands. The development of the fourth prototype, and the success of multiple nonclinical tests, indicated clinical trials were needed to confirm its efficacy when used by hospital personnel and to evaluate its acceptability by physicians. An OB-GYN department was considered to be the ideal place for testing because of the many short procedures requiring a scrub; for example, D&C's, abortions, laparoscopies, and deliveries.

The machine used consisted of two cylinders which accept the arms to above the elbow (Figs. 5 & 6). These cylinders were surrounded by multiple jets which delivered diluted Betadine Solution (The Purdue-Frederick Company, Norwalk, Conn.) at a constant rate of 1200 pulses per minute at pressures of approximately 120 psi. Four hundred milliliters of Betadine Solution was added to 27 gallons of warm tap water and recycled for multiple scrubs. The solution was changed every 24 hours. The personnel involved in this study were interns, residents, and one staff member of the Department of OB-GYN.

Comparison was made by utilizing fingertip cultures from ten individuals before and after five routine 10 minute scrubs, and five 90 second hydroscrub washings by the same ten individuals. The percent reduction in microbial count for the standard scrub was 90.8%, and for the hydroscrub 97.2%, suggesting the hydroscrub may be more effective. However,

the difference was not statistically significant. The percentage reduction was similar to results of studies by Dineen⁹ and Bernard¹⁰ using standard scrub methods. In our study, two individuals continued to have high bacterial counts after the routine scrub which indicated a shortcoming of the standard scrub. The results of the standard scrub depend on an individual's experience, technique, motivation, and circumstance. These factors are, for a large part, eliminated with the hydroscrub and more consistent results are achieved. Results of this study have shown the hydroscrub to be at least as effective as the standard scrub in reducing microbial counts. The hydroscrub caused less skin irritation and was well received by the staff using the machine. The time and water saved were also obvious benefits.

Since the conclusion of the study the data have been presented at several surgical meetings. One frequently asked question dealt with how well the areas beneath the fingernails were cleaned as compared with a routine scrub. USAIDR researchers recently evaluated this problem and found both methods equally deficient at reducing bacterial counts in this area. Regardless of the method used, bacteria continue to be cultured from beneath the nails. Another question asked was how soon could one expect this technique to be in general usage. Although the present device has proved the efficacy and feasibility of the method, several years are yet needed to make this device in an acceptable form for general hospital use. Once commercially developed, savings could be realized in time, elimination of brushes and sponges, and by recirculating water and antiseptic solutions.

Other uses have been suggested for the hydroscrub. In the neonatal unit where scrubbing is essential when going from patient to patient, a tremendous amount of time could be saved, and skin irritation minimized with greater protection for the patients. The same advantages could be derived by personnel on surgical wards attending numerous patients with contaminated wounds.

In summary, we have evaluated a new method of hand washing and found it to be effective, fast, nonirritating, consistent, and clinically acceptable. What remains now is further refinement so its cost and configuration may make it a reasonable alternative to the present method of presurgical scrub.

* * * * *

Commercial materials and equipment are identified in this report to specify the investigative procedure. Such identification does not imply recommendation or endorsement or that the materials and equipment are necessarily the best available for the purpose. Furthermore, the opinions expressed herein are those of the author and are not to be construed as those of the Army Medical Department.

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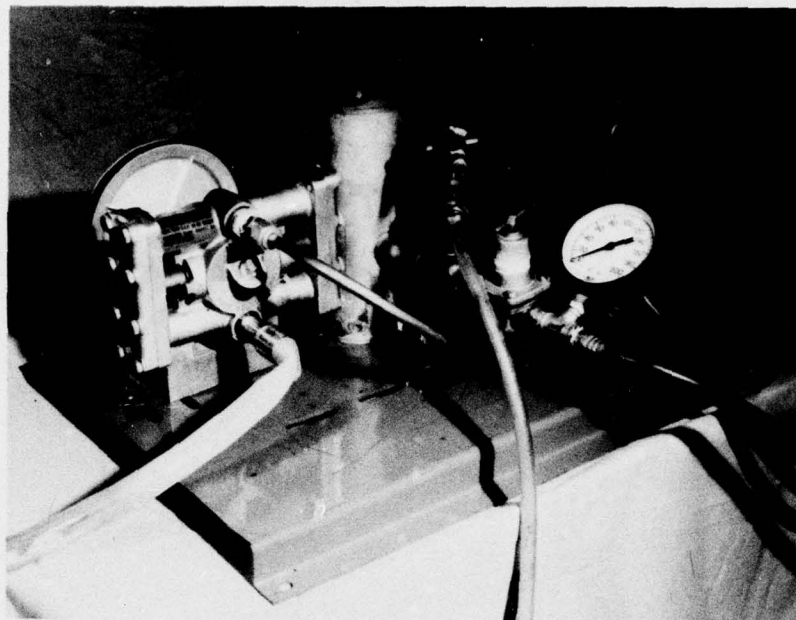
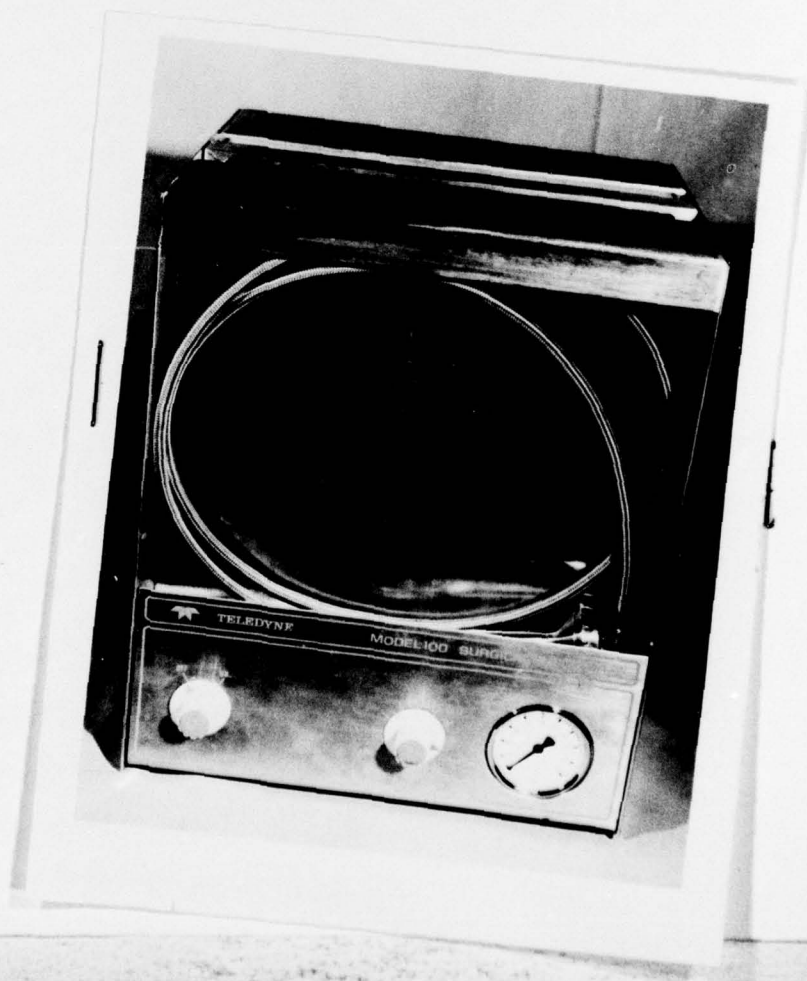


FIGURE 1. Original water lavage unit, which yielded stream of up to 200 psi.

FIGURE 2. Pulsating water jet device of type first used in combat zones for debridement of maxillofacial wounds.



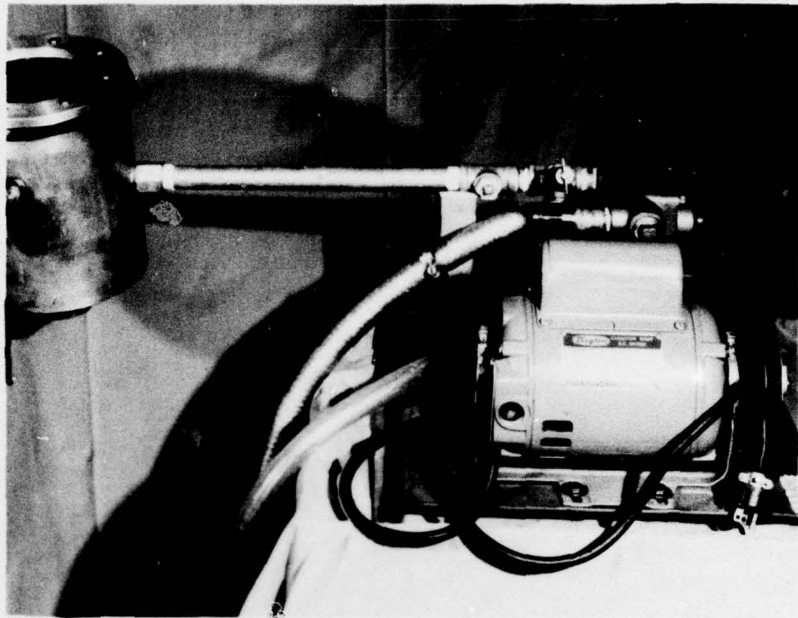


FIGURE 3. Prototype of hydroscrub device.

FIGURE 4. Portion of hydroscrub that receives operator's hand and forearm.



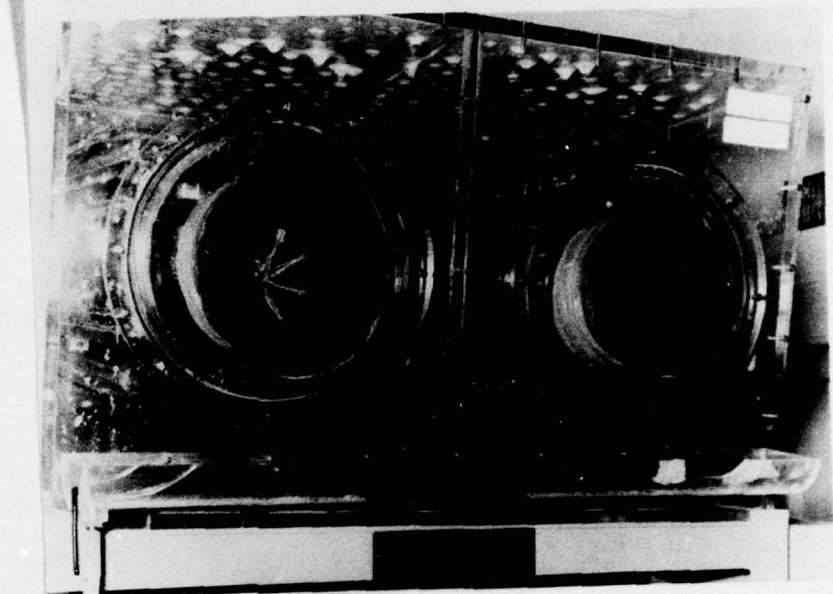


FIGURE 5. Front view of hydroscrub.

FIGURE 6. Hydroscrub in operation.

